

INCH-POUND

J-W-1177/38

June 10, 1988

## FEDERAL SPECIFICATION SHEET

WIRE, MAGNET, ELECTRICAL, CLASS 180, TYPE PEIN,  
POLYESTER, POLYESTER-IMIDE OR POLYESTER-AMIDE-IMIDE,  
OVERCOATED WITH POLYAMIDE, ROUND

This specification is approved by the Commissioner, Federal Supply Service,  
General Services Administration, for the use of all Federal agencies.

The requirements for acquiring the wire described herein shall consist of this  
specification and the latest issue of J-W-1177.

Classification: Class 180; type PEIN (single), type PEIN2 (heavy),  
type PEIN3 (triple); round.

Insulating materials: The conductor shall be coated with a dual film.  
The underlying coating shall be based on a  
polyester, polyester-imide or polyester-amide-  
imide resin. The superimposed coating shall be  
based on polyamide.

NEMA/ANSI equivalent: All test requirements are equivalent to MW-76 of  
NEMA MW 1000.

General requirements: See J-W-1177 for general requirements, quality  
assurance provisions, and packaging.

## Requirements:

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Dimensions	4.7.1.2	10-44	See table I.
Adherence and flexibility	4.7.2.1	10-44	No cracks visible in the film coating.
Elongation	4.7.5	10-44	Not less than the value in table II.
Heat shock	4.7.4	10-44	No cracks visible in the coating after conditioning as shown in table III.

AMSC N/A

DISTRIBUTION STATEMENT A

Approved for public release; distribution unlimited

FSC 6145

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## Requirements: (Continued)

Characteristics	Test procedure, see J-W-1177	Wire sizes, AWG	Requirements
Scrape resistance	4.7.6	10-30	Lowest grams-to-fail load for any of the three tests and the average of the three tests shall be not less than the values in table IV.
Springback	4.7.7	14-30	Not greater than the value in table V.
Dielectric strength	4.7.9	10-44	Not less than the value in table VI.
Continuity	4.7.10	31-44	The number of discontinuities shall be not greater than the number listed in table VII.
	4.7.11	10-30	
Thermoplastic flow	4.7.8	18, 36	Median not less than 225°C with heavy film coated wire.
Solubility	4.7.12	18	Heavy film coated wire shall not soften sufficiently to expose bare conductor when immersed in xylene or 50/50 parts by volume xylene/ethyl Cellosolve.
Dielectric strength at temperature	4.7.14	18, 36	Heavy film coated wire shall average not less than 3825 volts for 18 AWG and 1735 volts for 36 AWG.
Thermal endurance	4.7.15.1	18	180°C minimum with heavy film coated wire.
	4.7.15.2	10-44	1000 volts/mil minimum after 168 hours at 250°C.
		10-44	200°C minimum.

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TABLE I. Dimensions.

AWG size	Bare wire diameter, inch			Type PEIN		Type PEIN2		Type PEIN3	
	Minimum	Nominal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
10	0.1009	0.1019	1/0.1024	----	----	0.0031	0.1061	----	----
11	.0898	.0907	1/.0912	----	----	.0030	.0948	----	----
12	.0800	.0808	1/.0812	----	----	.0029	.0847	----	----
13	.0713	.0720	1/.0724	----	----	.0028	.0757	----	----
14	.0635	.0641	1/.0644	0.0016	0.0666	.0032	.0682	0.0048	0.0700
15	.0565	.0571	1/.0574	.0015	.0594	.0030	.0609	.0045	.0627
16	.0503	.0508	1/.0511	.0014	.0531	.0029	.0545	.0043	.0562
17	.0448	.0453	1/.0455	.0014	.0475	.0028	.0488	.0041	.0504
18	.0399	.0403	1/.0405	.0013	.0424	.0026	.0437	.0039	.0452
19	.0355	.0359	1/.0361	.0012	.0379	.0025	.0391	.0037	.0406
20	.0317	.0320	1/.0322	.0012	.0339	.0023	.0351	.0035	.0364
21	.0282	.0285	1/.0286	.0011	.0303	.0022	.0314	.0033	.0326
22	.0250	.0253	1/.0254	.0011	.0270	.0021	.0281	.0032	.0293
23	.0224	.0226	1/.0227	.0010	.0243	.0020	.0253	.0030	.0264
24	.0199	.0201	1/.0202	.0010	.0217	.0019	.0227	.0029	.0238
25	.0177	.0179	1/.0180	.0009	.0194	.0018	.0203	.0027	.0214
26	.0157	.0159	1/.0160	.0009	.0173	.0017	.0182	.0026	.0193
27	.0141	.0142	1/.0143	.0008	.0156	.0016	.0164	.0024	.0173

See footnote at end of table.

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TABLE I. Dimensions. - Continued

AWG size	Bare wire diameter, inch			Type PEIN		Type PEIN2		Type PEIN3	
	Minimum	Nominal	Maximum	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch	Minimum increase in diameter, inch	Maximum overall diameter, inch
28	0.0125	0.0126	0.0127	0.0008	0.0140	0.0016	0.0147	0.0023	0.0156
29	.0112	.0113	.0114	.0007	.0126	.0015	.0133	.0022	.0142
30	.0099	.0100	.0101	.0007	.0112	.0014	.0119	.0021	.0128
31	.0088	.0089	.0090	.0006	.0100	.0013	.0108	----	----
32	.0079	.0080	.0081	.0006	.0091	.0012	.0098	----	----
33	.0070	.0071	.0072	.0005	.0081	.0011	.0088	----	----
34	.0062	.0063	.0064	.0005	.0072	.0010	.0078	----	----
35	.0055	.0056	.0057	.0004	.0064	.0009	.0070	----	----
36	.0049	.0050	.0051	.0004	.0058	.0008	.0063	----	----
37	.0044	.0045	.0046	.0003	.0052	.0008	.0057	----	----
38	.0039	.0040	.0041	.0003	.0047	.0007	.0051	----	----
39	.0034	.0035	.0036	.0002	.0041	.0006	.0045	----	----
40	.0030	.0031	.0032	.0002	.0037	.0006	.0040	----	----
41	.0027	.0028	.0029	.0002	.0033	.0005	.0036	----	----
42	.0024	.0025	.0026	.0002	.0030	.0004	.0032	----	----
43	.0021	.0022	.0023	.0002	.0026	.0004	.0029	----	----
44	.0019	.0020	.0021	.0001	.0024	.0004	.0027	----	----

1/ The maximum bare wire dimensions may be exceeded up to the NEHA/ANSI maximum bare wire limit provided the minimum increase is maintained and the maximum overall diameter specified is not exceeded.

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TABLE II. Elongation.

AWG size	Elongation, minimum percent
10	36
11	36
12	34
13	34
14	33
15	33
16	33
17	32
18	32
19	31
20	30
21	30
22	29
23	29
24	28
25	28
26	27
27	27
28	26
29	26
30	25
31	24
32	24
33	23
34	22
35	21
36	20
37	20
38	19
39	18
40	17
41	17
42	16
43	15
44	14

TABLE III. Heat shock.

AWG size	Minimum elongation, percent	Mandrel diameter	Minimum temperature, °C
10-13	25	5X	200
14-30	20	3X	200
31-44	<u>1</u> /20	3X	200

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TABLE IV. Scrape resistance.

AWG size	Type PEIN		Type PEIN2		Type PEIN3	
	Scrape, grams-to-fail		Scrape, grams-to-fail		Scrape, grams-to-fail	
	Average	Minimum	Average	Minimum	Average	Minimum
10	---	---	1490	1270	---	---
11	---	---	1490	1270	---	---
12	---	---	1490	1270	---	---
13	---	---	1490	1270	---	---
14	840	715	1490	1270	1735	1475
15	780	665	1400	1190	1620	1375
16	735	625	1310	1115	1525	1295
17	690	585	1230	1045	1425	1210
18	645	550	1150	980	1335	1135
19	600	510	1070	910	1255	1065
20	560	475	1000	850	1180	1000
21	525	445	940	800	1115	945
22	490	415	880	750	1045	890
23	460	390	820	700	975	830
24	430	365	770	655	910	770
25	400	340	720	615	850	720
26	380	325	675	575	795	675
27	355	300	635	540	735	625
28	335	285	595	510	690	585
29	310	265	560	480	645	550
30	295	250	525	450	605	515
31	---	---	---	---	---	---
32	---	---	---	---	---	---
33	---	---	---	---	---	---
34	---	---	---	---	---	---
35	---	---	---	---	---	---
36	---	---	---	---	---	---
37	---	---	---	---	---	---
38	---	---	---	---	---	---
39	---	---	---	---	---	---
40	---	---	---	---	---	---
41	---	---	---	---	---	---
42	---	---	---	---	---	---
43	---	---	---	---	---	---
44	---	---	---	---	---	---

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TABLE V. Springback.

AWG size	Type PEIN	Type PEIN2	Type PEIN3
	Springback, maximum degrees per turn	Springback, maximum degrees per turn	Springback, maximum degrees per turn
14	42	42	46
15	46	46	49
16	50	50	53
17	54	54	58
18	58	58	62
19	62	62	66
20	66	66	70
21	53	53	53
22	58	58	58
23	62	62	64
24	67	67	69
25	72	72	74
26	76	76	80
27	50	50	55
28	55	55	60
29	61	61	65
30	66	66	70

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TABLE VI. Dielectric strength.

AWG size	Type PEIN	Type PEIN2	Type PEIN3
	Dielectric strength, minimum breakdown volts	Dielectric strength, minimum breakdown volts	Dielectric strength, minimum breakdown volts
10	----	5575	----
11	----	5400	----
12	----	5225	----
13	----	5050	----
14	3175	5700	7600
15	3075	5550	7400
16	3000	5400	7200
17	2925	5275	7025
18	2850	5125	6850
19	2775	5000	6675
20	2700	4850	6475
21	2625	4725	6325
22	2575	4625	6175
23	2500	4500	6000
24	2425	4375	5850
25	2375	4250	5700
26	2300	4150	5525
27	2250	4050	5400
28	2175	3950	5275
29	2150	3825	5125
30	2075	3725	5000
31	1875	3450	----
32	1675	3175	----
33	1500	2925	----
34	1350	2675	----
35	1200	2475	----
36	1075	2275	----
37	975	2100	----
38	850	1925	----
39	775	1775	----
40	700	1625	----
41	625	1500	----
42	575	1375	----
43	500	1250	----
44	450	1175	----



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TABLE VII. Continuity.

AWG size	Maximum number of discontinuities		
	Type PEIN	Type PEIN2	Type PEIN3
14-24	25	5	3
25-30	25	7	5
31-44	25	-	-

Part number: Magnet wire covered by this specification shall be defined by the following part numbering system. Example:  
M1177/38-02C029.

M1177/38-	02	C	029
Federal specification identifier	Two digit type code	Single letter conductor code	Three character size code

The following codes shall apply:

Type	Type code	Conductor	Conductor code
PEIN	01	Copper	C
PEIN2	02	Aluminum	A
PEIN3	03	Nickel-coated copper	N
		Silver-coated copper	S

The size code shall be the bare wire dimension. AWG wire size shall be used.

Intended use: Type PEIN magnet wire is intended for use in 180°C applications similar to those for which type H is used and where good windability is desired.

#### MILITARY INTERESTS:

##### Custodians:

Army - CR  
Navy - SH  
Air Force - 85

##### Review activities:

Army - AR, ER, MI  
DLA - IS

##### User activities:

Army - ME  
Navy - AS, CG, MC, OS

#### CIVIL AGENCY COORDINATING ACTIVITIES:

GSA - FSS, PBO, PCD  
INTERIOR - BLM  
HHS - FDA  
DCGOVT - DCG  
NASA - JFK  
COMMERCE - NBS  
TRANSPORTATION - APM, FAA

##### Preparing activity:

Navy - SH  
(Project 6145-1111-34)

